Opening a can of worms!

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explain how the Great Science Share for Schools encouraged children to get hands-on with contemporary scientific research in Scotland

Based at the University of Edinburgh's Roslin Institute, we are a small team of public engagement with research professionals. We promote and facilitate interactions between our scientists and the public by creating accessible events and resources. The Roslin Institute, made famous by the creation of Dolly the Sheep in 1996, is a centre for animal science research funded by the Biotechnology and Biological Sciences Research Council and is home to around 500 research scientists and technical staff, postgraduate students and vets. Our public engagement activities have a strong emphasis on breaking down barriers to engaging with science, through challenging existing stereotypes and revealing who scientists are and how they use the scientific method in their work.

Our primary school programme offers engaging, hands-on activities for pupils and their teachers. Linked to the *Scottish Curriculum for Excellence*, with an emphasis on talking to real scientists, they expand scientific vocabulary and build confidence in science. To extend the reach of our engagement and as part of the Great Science Share for Schools (GSSfS), we developed a free toolkit, *Opening a Can of Worms,* which supports teachers and 9-12 year-olds to use the scientific method to study animal behaviour in their own classrooms.

Since 2018, we have engaged over 1000 local school pupils through the GSSfS and have extended engagement through a free-to-download online version of the toolkit to 12,000 people globally. During the 2020 pandemic, a home-learning version of the toolkit brought real-life research to a further 5,000 school pupils in their homes across the UK.

Building partnerships

In 2018, when the Easter Bush Science Outreach Centre (EBSOC) was only a few months old, we heard about the GSSfS campaign and knew that its aims and values aligned perfectly with the objectives of the Roslin Institute's Public Engagement Strategy. We decided to jump on board, starting our GSSfS journey on a small scale with just a single class of 22 pupils from one local primary school. The experience was incredibly rewarding for us, reflected in teacher comments too!

'Our involvement in the GSSfS was both positive and motivating for pupils and staff. The ownership that the children had over their own investigations, being decision makers and working alongside scientists, brought their findings to life. This had a further impact on their understanding of how science works and on their

The EBSOC team!

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confidence to share their results with others. It was fantastic as a teacher to witness and it was a great opportunity to collaborate with our local research institute' (Tori Trueman, P5 class teacher).

In 2019, to spread the word about the GSSfS, we organised information sessions in EBSOC for colleagues from across the University of Edinburgh, as well as other higher education organisations, local STEM organisations, local authorities and government education teams.

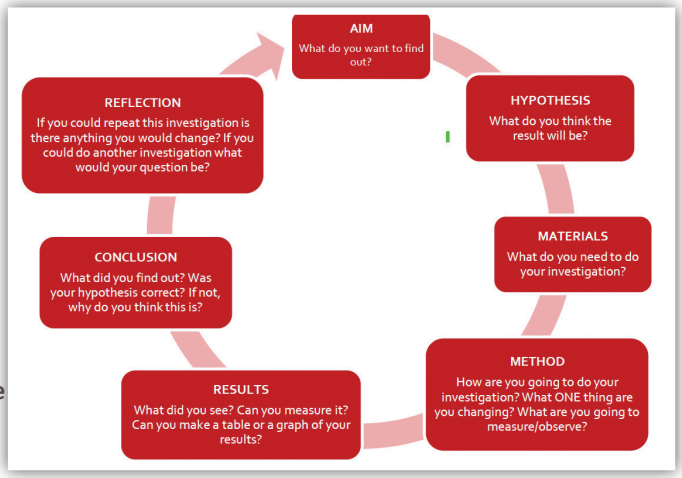
We ran teacher and STEM leader meetings for our local primary schools, with the aim of building up a working group of GSSfS Teacher Ambassadors to develop and share the campaign with their schools and school leaders. From these interactions, the *GSSfS Midlothian Primary School STEM Cluster Project* was born and we are currently working with P5-P7 classes (age 10-12 years) at four local primary schools, with around 20 teachers and 600 pupils.

Keeping it real

Roslin Institute scientists come from a range of social and scientific backgrounds and they work with a huge variety of animals, from poultry to pigs and bees to salmon, with the aim of improving animal health and welfare. Their research can be complex, abstract and difficult to make relevant to school pupils and their teachers, and can be challenging to talk about, such as the use of animals in research. A recent UK government survey shows that there is a desire from the public for more direct engagement from scientists, in particular around the societal and ethical implications of their research (PAS, 2019).

Teachers told us that the main barriers to doing more hands-on science in their own classrooms were confidence, time, resources and a pressure to focus on numeracy and literacy. They asked for more support to use the scientific method in schools. This knowledge led to a new resource that aimed to:

Scientific method 'There is no end to the scientific method cycle; this positive feedback loop means that the results from one inform the next.'



- **increase their confidence and that of pupils in using the scientific method;**
- **raise awareness of how science is carried out in the real world and by whom;**
- **give our scientists an opportunity to get real experience of working alongside local primary children; and**
- **offer a tangible way to effectively engage upper primary pupils with contemporary research.**

The toolkit: *Opening a Can of Worms*

Opening a Can of Worms supports teachers to use the scientific method cycle with their pupils via a series of simple, pupil-led experiments using earthworms. It encourages pupils to create their own scientific questions and helps teachers to facilitate good-quality, hands-on learning.

The toolkit highlights the importance of studying animal behaviour, introduces the use of animals in research and gives teachers and pupils some practical experience of designing their own investigation using the scientific method as a framework, while also considering the welfare of the worms.

The toolkit includes:

- **all the equipment needed, including the worms!**
- **teacher guide* (including links to the science curriculum, literacy and numeracy skills)**
- **pupil workbook*; and class presentation*.**

*These elements are also available as a free digital download.

'My class really enjoyed carrying out the research question and all the equipment provided was excellent.'
'Brilliant activity and very well resourced. Children were engaged, interested and excited about the investigation.'

Professional development

In addition to the impacts on pupils, taking part in the GSSfS allowed us to pursue our strategic objectives of building a network of local classroom practitioners and increasing their confidence in STEM, and developing the engagement skills of our scientists.

One teacher from Strathesk Primary School said that she got involved because she wanted *'to bring in more science into the classroom. Get children more interested in STEM jobs and so children can get more hands-on in science and sharing their learning'.*

Many of the teachers said that they hoped to gain more confidence in teaching science, using the scientific method themselves and supporting their pupils and colleagues to use the scientific method.

Research staff and students also benefited from the experience:

'I gained experience in improving my communication skills and encouraging kids to think scientifically in a very simple way. The enthusiasm of the kids to learn more about my work in chickens has encouraged me to continue supporting

Typical timeline of GSSfS activity across an academic year

December	February	March	April/May	June	June/July
First meeting for teachers, STEM organisations and HE colleagues – introductions and scene-setting	Teacher professional development session to review practice and gain feedback from teachers about how to use the toolkit	EBSOC team creates the toolkits and delivers them to schools	Teachers work with pupils to create their investigations using the toolkits in school	Visits to schools with scientists – pupils share their science!	Evaluation of project – pupil, teacher and scientist perspectives

GSSfS and do as much as I can to help kids in building up their scientific thinking if they wish to be future scientists' (Marwa Hasan, PhD student).

All the teachers agreed that the project provided an opportunity to learn about real-world science and, when we asked teachers what they thought the impact of the project was, they said:
'It was so important to have visitors coming as they link the learning to the world of work and jobs out there.'
'It made science "real" for them and introduced them to the working world of science.'
When asked, pupils said:
'It was fun to experiment and find your results.'
'It was inspiring.'

Reflections

There is concern that too few young people are choosing to study science beyond 16 years old, and that those who do pursue STEM subjects via higher education and STEM careers do not reflect the diversity of the UK population (Archer, 2013). Of the eight dimensions of Science Capital (Godec *et al*, 2017), our evaluation and experience suggest that this project has a significant positive contribution towards four:

Our PhD student Marwa, enthusiastic to support primary scientists in the *Great Science Share for Schools*

For us, as public engagement champions, being part of the GSSfS has enabled us to fast track the building of strong, collaborative, long-term relationships with our local schools, and gives:

- **local children the opportunity to investigate real-life science, meet real scientists and improve their science capital;**
- **local teachers the confidence and support to work scientifically in their classrooms;**
- **our scientists positive opportunities to communicate their research and develop their science communication skills; and**
- **our organisation an opportunity to have a meaningful impact in our local community.**

For the *2021 GSSfS Midlothian STEM Cluster Project,* we aim to do a more robust evaluation of the impact of the project on science capital and continue to evaluate the impact of this project on teacher and researcher professional development. Jayne is also embracing her role as Great Science Share Regional Champion!

Science capital dimension	Approach
Scientific literacy	The toolkit includes a *Real-Life Research Fact File*, a critical reading text to introduce and/or develop pupils' knowledge about how science works and an understanding of the real-world science that is happening in their local university. We noted improved scientific literacy – when asked, 90% of the pupils understood what 'aim', 'hypothesis' and 'conclusion' meant after the 2018 GSSfS project.
Knowledge about transferability of science	The toolkit focuses on using the scientific method and exercising broader scientific skills such as problem-solving, resilience, teamwork and communication. 80% of the pupils that took part in the 2018 GSSfS project said that they could design an experiment again.
Knowing people in science-related roles	The GSSfS experience includes a school visit from scientists who are working in their local community. During these visits, we facilitate discussion between the pupils and the scientists to create meaningful interactions. Getting a chance to meet 'real scientists' is often reported as one of the highlights of our GSSfS sessions by the pupils.
Science-related attitudes, values and dispositions	Encouraging pupils to create and direct their own investigations and share their science with professional scientists placed value on their contribution. Meeting our scientists also reveals STEM careers and helps challenge typical educational and social stereotypes of scientists.

Resources

Opening a Can of Worms and *Science @ Home: Wonder with Worms* investigation pack can be downloaded for free from **www.ebsoc.ed.ac.uk**

Primary teacher workshops at EBSOC, *Getting Hands-on in your Classroom with the Scientific Method*, based on this toolkit, with a bag of equipment to take back to your classroom. To find out more, visit **www.ebsoc.ed.ac.uk**

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